Nykredit markets

CK92NYK debtor distributions

The valuable information from CK92 – now without the noise!

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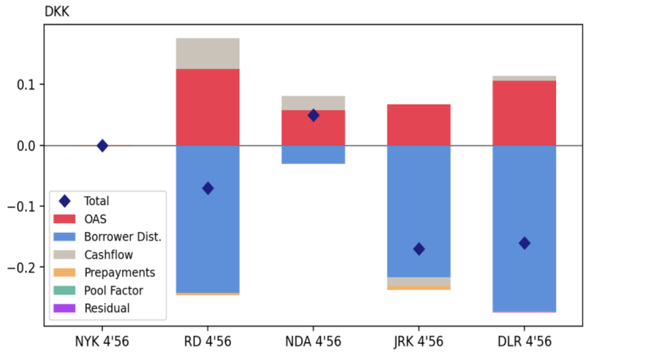
- Debtor distributions contribute valuable information about prepayment risk across bonds
- Early in a bond's opening period, debtor distribution may be more or less random and create "noise" in key figures
- Our solution, the easy-to-pronounce CK92NYK, incorporates the expected composition of any future issuance

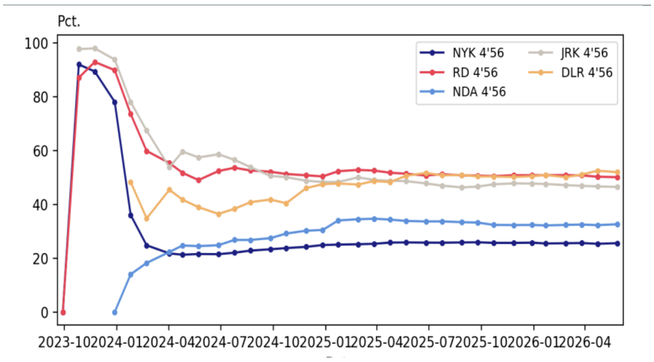
Debtor distributions (CK92) contain important information about the risk of prepayments in a given fixed-rate callable bond, and, therefore, about its pricing. However, before a certain volume of loans has been built up in a bond, the debtor distribution may be more or less random, which can create noise in the pricing. We saw this at the start of the opening period for 4'56 bonds, and we may very well see something similar with the 4'59 bonds. Our new CK92NYK debtor distributions, which draw on the approach behind our CKNYK cash flows, combine a bond's current debtor distribution (CK92) with an expectation of the composition of future issuance. This makes it possible both to make use of the information in CK92 and to avoid noise in the key figures. To begin with, at EOD 29 June, four key figures (OAS, OAD, OAC and vega) based on CK92NYK will be added in new, separate columns to our key figures file for 30Y A/IO callables.

4'56: Decomposition of price differences between issuers



Price differences relative to NYK 4'56 (blue squares) as well as model-based decomposition.

The share of loans exceeding DKK 3 million in 4'56 A



Shows the development since the first data on the debtor composition (CK92).

Source: Nykredit Markets

Debtor distributions lead to price differences

It is common knowledge that larger borrowers are more likely to prepay fixed-rate loans when they stand to gain from it. Our prepayment model therefore also uses information from the debtor distributions published by issuers when pricing callables.

According to the model, differences in debtor distributions are the main reason for the price differences observed in, for example, 4'56 A across the various issuers, see the top-left chart. In principle, the price differences shown in the chart could be related to issuer-specific differences in prepayment propensity, rather than to the debtor distribution of the individual bond. However, experience with prepayments in 5% bonds clearly indicates that the distribution of loan amounts in the individual bond does play a role, see here.

Noise at the beginning of the bond's opening period

One challenge in using debtor distributions in a prepayment model is that the debtor composition may be more or less random until a certain volume has been issued in the bonds.

For example, we saw that the share of loans above DKK 3 million was zero the first time we received debtor distributions for NYK's and RD's 4'56 A. The second time we received debtor distributions, this share jumped to around 90%, after which it gradually declined to a more typical level for the issuers in question as the bonds were built up to a certain size, see the bottom-left chart.

In addition, JRK 4'56 and NDA 4'56 initially had a very high and a very low share, respectively, of loans above DKK 3 million.

The share then converged towards a more normal level for the respective issuers.

The extreme debtor distributions at the beginning of the issuance period are, of course, correct. However, if one were to rely uncritically on these distributions, it would not provide a fair presentation of the expected prepayment levels across the majority of the relevant future prepayment scenarios. An over- or underestimation of prepayment risk based on an extreme debtor distribution affects both calculated OAS levels and key figures such as OAD and OAC.

CK92NYK!

We have addressed this challenge by weighting the current debtor distribution in a given bond together with the expected composition of future issuance in that bond – we call the resulting weighted debtor distribution CK92NYK.

Broadly speaking, the weights reflect the relationship between the current outstanding amount in the bond and the expected future issuance. This relationship is calculated using the same approach as the one we have applied in the construction of our CKNYK cash flows (described here) The timing of the expected future prepayments is also taken into account. The details of the weighting are described in Appendix A below.

Early in a bond's opening period, when the debtor distribution is based on very limited issuance, the bond's actual debtor distribution will carry a low weight. Pricing will therefore predominantly be based on the expected debtor composition of future issuance.

Conversely, the bond's actual debtor distribution will carry close to full weight towards the end of the opening period, when expected future issuance is limited relative to the outstanding amount in the bond.

How are expected debtor distributions constructed?

The expected debtor composition of future issuance is, broadly speaking, formed by looking at the composition of issuance in bonds of the same type from the same issuer over the past 18 months (this is described in more detail in Appendix B below).

It is thus a backward-looking expectation that gradually adapts to changes in the debtor composition of issuance in a given bond type (these changes can be fairly significant over time, as also shown in Appendix B).

Over time this will tend to reduce the difference between the bond's actual debtor distribution and the composition of expected future issuance.

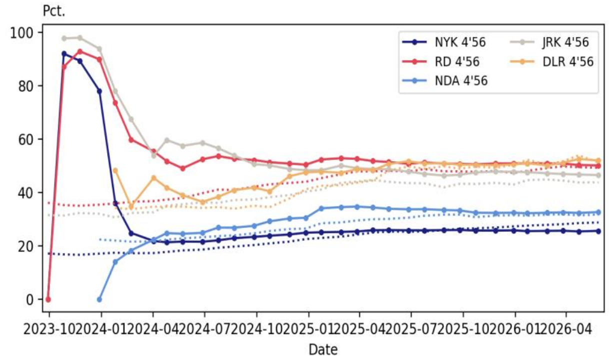
Example: 4'56 A

For NYK 4'56 A, the expected composition of future issuance is calculated by looking at the composition of NYK's issuance in 30-year annuities, across coupons, over the past 18 months.

At the beginning of the opening period for NYK 4'56 A, this was largely based on issuance in NYK 5'56 A. After 4'56 A became the primary OTR bond, expected future issuance was increasingly determined by issuance in 4'56 A itself over the past 18 months.

The chart below shows the share of loans above DKK 3 million from the actual debtor distributions of the 4'56 bonds (unbroken lines), as well as the constructed expectation for future issuance (broken lines). The weighted CK92NYK distribution will lie somewhere between these two – initially closest to the expectation for future issuance, and later closer to the actual distribution.

Share of loans above DKK 3 million and expectation for future issuance



The unbroken lines show the share of loans in 4'56 over time based on actual debtor distributions (CK92), while the broken lines show the expected share of loans above DKK 3 million in future issuance.

Source: Nykredit Markets

The chart shows that, at the start of the opening period, the constructed expectations for future issuance may be significantly better yardsticks for where the share of loans above 3 million DKK will ultimately settle than the actual debtor distributions.

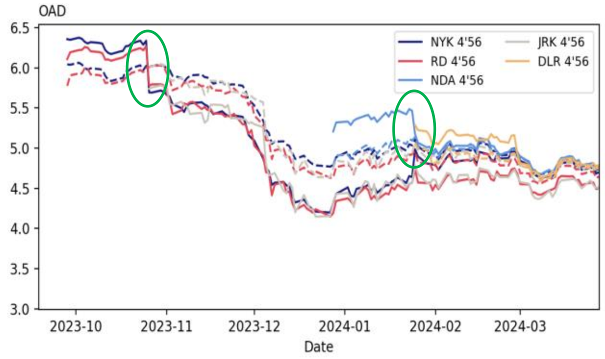
Furthermore, the composition of a given bond does not necessarily end up exactly where the expected composition was at the start of the bond's opening period. But the forecast errors are relatively limited, and because expected future issuance is continuously updated based on the latest actual issuance, this does not give rise to a "permanent" error.

So what does this mean?

If we look, for example, at OAD in 4'56 bonds, the use of the weighted distributions means that fairly significant jumps in the key figures are avoided, see also the top chart overleaf. Early in the issuance period, OAD for NYK and RD 4'56 A therefore suddenly falls by more than 0.5 if the key figure is calculated on the basis of the actual debtor distribution.

With CK92NYK, this jump in OAD, which is largely noise, is avoided. Thus, the jump can be attributed to the large and somewhat random fluctuations in the actual debtor composition described above, which occur while the composition is still based on fairly limited issuance. Something similar is also seen for NDA 4'56, for example.

CK92NYK reduces the noise in the key figures



The unbroken lines indicate OAD calculated based on the most recent actual debtor distribution, while broken lines indicate OAD calculated based on CK92NYK.

Source: Nykredit Markets

Appendix A: CK92NYK weighting

The combination of the actual debtor distribution (CK92) and the expected composition of future issuance is done using CKNYK weights:

$$W_0, \ldots, W_n \quad \text{where} \sum_{i=0}^{n} W_i = 1$$

Where n denotes the remaining payment dates in the bond's opening period. W_0 is the share that the amount already outstanding in the bond (represented in CK92) constitutes of the expected total issuance in the bond. W_1 is the share that future issuance up to the next payment date is expected to constitute, W_2 is the share that issuance between the next and the subsequent payment date is expected to constitute, and so on.

These CKNYK weights are estimated using our prepayment model (also used for CKNYK cash flows) under the assumption that future issuance takes place in the bond when it is trading between a price of 96 and a price of 100.

Given an expected composition of future issuance, the debtor composition for future payment dates can now be calculated as:

$$D_g^y = \begin{cases} D_g^{CK92} & \text{for} \quad j = 0 \\ (1 - P_y) D_g^{j-1} + P_y D_g^F & \text{for} \quad j \geq 1 \end{cases}$$

Where D_g^{CK92} and D_g^F are the share of loans in debtor group g from the actual debtor composition and the composition of expected future issuance, respectively, while $P_y = W_y / \sum_{i=0}^{y} W_i$.

Given the expected distributions for future payment dates in the opening period, the weighted CK92NYK distribution can be calculated as

$$D_g^{CK92NYK} = \sum_{i=1}^{n+m} \gamma_i \left(\mathbb{I}_{i \leq n} D_g^i + \mathbb{I}_{i > n} D_g^n \right)$$

Where m denotes the number of payment dates from the end of the opening period until maturity, and γ_i denotes the expected relative prepayments and principal payments at future payment dates. γ_i is calculated on the basis of the bond's option-adjusted cash flow.

Weighting by expected future repayments ensures that the actual debtor distribution carries a high weight if the bond is already a prepayment exposure during the opening period. In that situation, the near-term prepayments, which will largely depend on the current actual debtor distribution, are most relevant for pricing. This applies even if the outstanding amount remains modest, and even if further issuance may occur later in the opening period, potentially after the bond has already experienced substantial prepayments.

The debtor composition is also a matter of the average loan amount within a given debtor group, and not only the share of loans in that group. These are constructed using the same basic approach.

Appendix B: Expected composition of future issuance

As a starting point, expected future issuance is constructed on the basis of monthly observations of positive changes in the loan volume in the individual debtor groups (CK92 data is published monthly).

In a given month, these changes are aggregated across all relevant bonds. The calculation is specific to the issuer, maturity and repayment profile, and for the expected composition of future issuance in, for example, NYK 4'56 30-year annuities, the relevant bonds primarily comprise NYK 5'56, NYK 4'56 itself and NYK 3.5'56 (the same applies to 3.5'56).

The monthly changes in loan volume in the various debtor groups are used to calculate each debtor group's share of the relevant issuance in that month. Simple averages are then calculated for the share of loans in a given debtor group over the past 18 months. The result is used as an expression of the expected composition of future issuance.

The time period, namely the 18 months, represents a trade-off; on the one hand, it helps avoid excessive noise in the calculated shares over time (which in isolation points towards using a longer period) and on the other hand, it helps ensure that the shares, as far as possible, reflect the current composition of issuance, which may change over time (which in isolation points towards a shorter period).

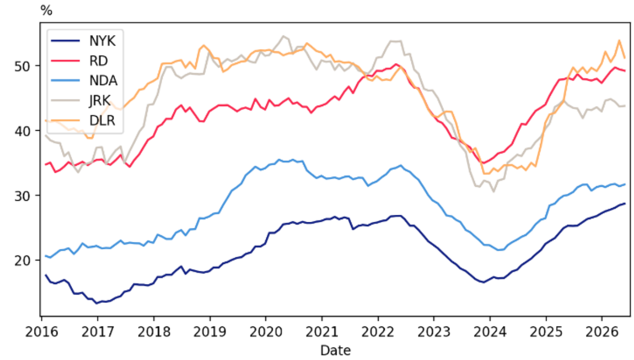
The resulting expected debtor composition of future issuance varies considerably over time (reflecting variation in the composition of actual issuance over time), as also shown in the chart at the top of the next page.

Months with very low total issuance are excluded, and 30-year annuities where loans to private individuals account for less than 20% in a given month are not included in the calculation for that month (this means, among other things, that the composition of issuance in 1'56 A is not included in the calculation of expected future issuance in 4'56 and 3.5'56).

The average loan amount of expected future issuance is calculated for a given debtor group using the same basic approach.

In some cases, typically for bond types or issuers with limited issuance, the method described above is not sufficiently robust. In such cases, an aggregation of the latest CK92 data across relevant bonds is used instead (where open bonds are assigned a weight of 1, while closed bonds are gradually downweighted from 1 on the closing date to 0 three years later).

Expected share of loans above DKK 3 million in 30-year annuities



Shows the expected future share of loans above DKK 30 million calculated based on the above method for 30-year annuities.

Source: Nykredit Markets